July 22, 1988

D-75

D72

N-22

Bikini Atoll Rehabilitation Committee

SUMMARY REPORT
(Report No. 6)

July 22, 1988

Submitted to the U.S. Congress, House and Senate Committee
on Interior Appropriations, pursuant to Conference Report for the
H.R. 2712 and Public Law 100-202.
Department of Interior Accounts No. 14X0414/TT - 1580X08; Contract No. 14-01-0001-85-C-11
Washington, D.C.

D-75
RMI
John Rudolphs files
O-File
Marshall Islands 1988

BIKINI ATOLL REHABILITATION COMMITTEE

SUMMARY REPORT

(REPORT NO. 6)

JULY 20, 1988

Submitted to the U.S. Congress, House and Senate Committees on Interior Appropriations, pursuant to Conference Report for H. R. 2712 and Public Law 100-102. Department of Interior Account No. 14X0414/TT-1580X08; Contract No. 14-01-0001-85-C-11. Washington, D. C.

ABSTRACT

The principal findings of this Summary Report of the Bikini Atoll Rehabilitation Committee relate to resettlement per se and to contamination control.

1. For orientation, conceptual plans for resettlement are presented; the cost is about $53 million. These plans include roads, docks, water supply, sewerage, housing, and other community facilities. Obviously, their cost might be more or less depending on details.

2. Contamination control has been considered from the points of view of engineering and of environmental impact. The principal contaminants (half-lives) are: cesium-137 (30 years), strontium-90 (29 y), plutonium-239 (24,000 y), plutonium-240 (6,500 y), and americium-241 (432 y). Of these, cesium-137 determines more than 90% of the dose. Detailed environmental studies have been made of the whole atoll, and especially of Eneu and Bikini.

3. On the basis of current federal guides, we conclude that Eneu may be resettled now. Eneu may therefore serve as a base of operations for the rehabilitation of Bikini Island, the principal seat of residence.

4. We have considered three major types of contamination control

4.1 Irrigation with sea water can be effective, but is impractical.

4.2 The removal of top soil is effective, owing to the fact that soil contamination falls off progressively with depth. The advantage of it is permanence. The principal disadvantages are: (a) the residual soil is poor soil; (b) the resulting spoil must be disposed of: (c) the land must be restored; (d) the cost is greater than a competing method; (e) the time and effort for soil restoration (some years) might delay resettlement.

4.3 Potassium-salt treatment of the contaminated soil diminishes the uptake of cesium-137 by plants. The advantages of the mehtod are relative simplicity, and less cost. The disadvantages are that the contaminating radionuclides remain until they disappear by spontaneous decay, a process which requires 75 years for cesium-137 and strontium-90. Psychologically this may be worrisome. Furthermore, the exact 75-year treatment schedule is not known. It appears now that once in 5 years may be enough, or perhaps even less frequently.

5. Estimates of total costs range from $66 to $98 million for potassium treatment, depending on the number of treatments and their details;, for soil removal, $84 - $100 million depending on spoil disposal.

BIKINI ATOLL REHABILITATION COMMITTEE

MEMBERS;

HENRY I. KOHN, PH.D., M.D., Chairman; David Wesley Gaiser Professor Emeritus of Radiation Biology, Harvard Medical School; current address: 1203 Shattuck Ave., Berkeley, CA 94709 (415-526-0141)

ARTHUR S. KUBO, Ph.D., M.B.A., P.E., 4718 Western St., Fairfax, VA 22030 (703-352-1238)

FRANK L. PETERSON, Ph.D., Professor of Hydrogeology and Chairman of the Department of Geology and Geophysics, University of Hawaii, Honolulu, Hawaii 96822 (808-948-7897)

EARL L. STONE, Ph.D., Charles Lathrop Pack Professor Emeritus of Forest Soils, Cornell University; current address: Department of Soil Science, 2169 McCarty Hall, University of Florida, Gainesville, FL 32611 (904-392-1956)

Secretary to the Committee: Irene Heller, Berkeley, CA

TABLE OF CONTENTS

ABSTRACT		3
BARC MEMBERSHIP		4
1. BACKGROUND		7
	1.1 History	7
	1.2 Task	8
2. FIELD TRIALS		11
	2.1 Program	11
	2.2 Soil Removal (excavation)	14
	2.3 Potassium (K) Treatment	15
	2.4 Sea Water Treatment	16
	2.5 Comment	16
3. RESETTLEMENT		18
	3.1 Underlying Considerations	18
	3.2 Water	20
	3.3 Resettlement Plans	21
	3.4 Environmental Impacts	22
4. REHABILITATION COSTS		25
5. FUTURE		26
6. REFERENCES		27
7. TABLES		
	Table 1. BARC Financial Summary	29
	Table 2. Islands of Bikini Atoll	30
	Table 3. Whole-body radiation dose (1989)	31
	Table 4. Budget Estimates	32
8. FIGURES		
	Fig. 1. Location of the Marshall Islands	33
	Fig. 2. Bikini Atoll, Cesium-137	34
	Fig. 3. Eneu Island - Specific activity of radionuclides as a function of soil depth	35
	Fig. 4. Bikini Island - Specific activity of radionuclides as a function of soil depth	36

(cont.)

Fig. 5. Eneu - Drinking coconut meat: potassium treatment 37
Fig. 6. Bikini - Drinking coconut meat: potassium treatment 38
Fig. 7. Bikini - Corn: potassium treatment 39
Fig. 8. Bikini - Sweet potato meat: potassium treatment 40
Fig. 9. Eneu Base Facilities, Holmes & Narver 41
Fig. 10. Bikini Island Uses, Rivkin Associates 42

9. APPENDICES

A. CONTAMINATION CONTROL AND REVEGETATION
W. L. Robison, E. L. Stone

B. WATER
F. L. Peterson

C. REHABILITATION COSTS
Arthur S. Kubo

D. RADIATION DOSAGE
Henry I. Kohn

1. BACKGROUND

1.1 History

Bikini Atoll, in the Marshall Islands Republic, is located 2500 miles southwest of Hawaii at 11°35'N, 165°25'E. It comprises a ring of 23 small islands with a total land area of 2.7 sq. miles plus 0.5 sq. mile of intertidal area. Owing to their size and elevation above sea level, two islands are of prime importance for settlement: Bikini (.87 sq. miles), the traditional site, and Eneu (.47 sq. miles), an ancillary one (Figs. 1 and 2).

In 1947 the U. S. Government, then serving as a U. N. Trustee for the Territory, removed the 167 inhabitants of Bikini Atoll so that the atoll could be used for the testing of nuclear weapons. That program ended in 1958 after 23 tests which had rendered the atoll unsafe for human habitation.

The Bikini people were settled first on Rongerik Atoll, then briefly on Kwajalein, and finally in September 1948 on Kili Island, some 425 miles south of Bikini Atoll.

Twenty years later President Johnson was advised by the Atomic Energy Commission that the main islands of Bikini Atoll were safe (but should be monitored in the future), and permission for resettlement was given. In 1969, therefore, the Department of Defense and the Atomic Energy Commission cleared the atoll of brush, debris, and abandoned equipment, and during 1970-73, thousands of coconut trees and some breadfruit and pandanus were planted on Bikini and Eneu Islands with the help of a number of Bikini people who had begun the resettlement.

In 1978, however, an examination of these settlers on Bikini Island by a team from Brookhaven National Laboratory revealed significant body burdens of the radionuclide cesium-137. As a result of these and additional findings by the Department of Energy, the 139 settlers were evacuated in August 1978, and settlement has not been allowed by the U. S. since that time.

The scarcity of land in the Marshall Islands and the cultural significance of land ownership make resettlement of Bikini Atoll a matter of overriding importance to the Bikini people. In this connection it should be noted that while 167 Bikinians left the Atoll in 1946 prior to the bomb tests, the population today totals some 1200, of whom some 500 dwell on Kili Island, about 200 on Ejit Island in Majuro Atoll, and the rest elsewhere in the Marshalls. The Committee estimates that more than 75 per cent of the population is under 30 years of age, and perhaps as many as 50 per cent are under 16.

On January 24, 1979, the U. S. conveyed Bikini Atoll back to the Bikinians, who therefore legally have all the rights of ownership. Bikini Atoll is part of the Republic of the Marshall Islands, which has a total land area of 170 km² (66 sq. miles) scattered over 700,000 km² of the central Pacific Ocean, and a population of some 35,000 people.

1.2 Task

The Bikini Atoll Rehabilitation Committee (BARC) was established at the request of Congress (House Report 99-450) to report independently on the feasibility and cost of rehabilitating Bikini Atoll.

Planning for rehabilitation involves two interdependent tasks. The primary one for present consideration deals with how soil contamination from fallout (cesium-137, strontium-90, and a smaller fraction of transuranics), chiefly from the 1954 nuclear weapons tests, can be controlled to meet the Federal Protective Action Guides or their equivalent. The second task relates to the civilian needs of resettlement including power, water supply, vegetation and general socioeconomic planning.

Since 1978 field studies at Bikini Atoll (along with others in the Northern Marshalls) have been carried out by the Environmental Sciences Division, Lawrence Livermore National Laboratory (LLNL). BARC's assignment in 1985 was to review the results of the Bikini program, and to supplement it by (a) providing support for particular areas, and (b) employing its own subcontractors to carry out additional specifically defined missions.

To accomplish this, the original 1985 DOE contract with BARC specified the following areas of study and/or review (BARC Reports in parentheses):

(a) Distribution of contamination (Nos. 1 & 4)
(b) Mapping of the principal islands (No. 3)
(c) Pilot decontamination studies (Nos. 1-5)
(d) Suggested preliminary draft environmental impact statement (Supplementary documents 1, 2, 3; also Eneu Assessment)
(e) Engineering studies (No. 5)
(f) Water supply (No. 4)
(g) Socioeconomic planning (No. 4)
(h) Costs (Nos. 4 & 5)

Expenditures on these projects are summarized in Table 1.

The LLNL group has reported on its findings relating to contamination and will continue to do so in a series of technical reports from that Laboratory or in the scientific literature.

In this Summary Report we shall consider all of the findings in relation to the safety of resettlement and the needs of rehabilitation. The findings are grouped under three major headings: Field Trials, to determine the extent of radionuclide contamination and how it may be controlled; Resettlement & Rehabilitation Costs; and the Future.